

# **Neurological Examination In Infants & Children**

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# NEUROLOGIC EXAMINATION

Typically in a **standard manner**:

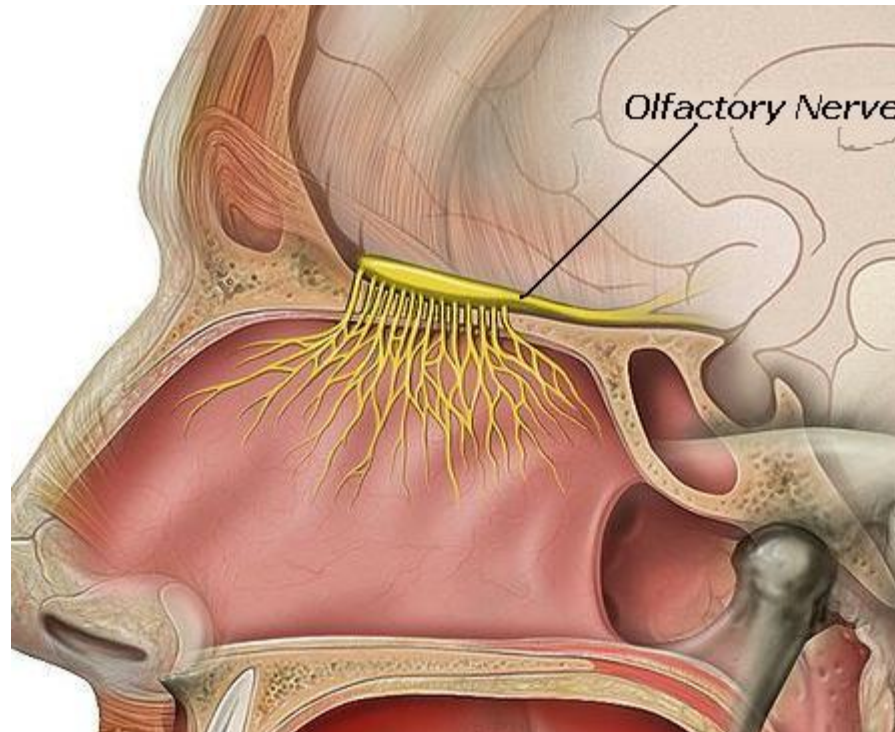
- Beginning with the **mental status** assessment and followed by cranial nerve, motor, cerebellar, and sensory examinations.
- **Starts with the lower extremities** and ends with the cranial nerve examination.

# Mental status

- ❑ **Higher cortical functions:** observations of infants and toddlers during play can provide valuable information about the patient's attention span and problem solving abilities.
- ❑ **involves an assessment of the child's development**
  - Including social and language skills.
- ❑ **In older school children:** Level of alertness, Language, Memory (short and long), Calculation, Construction, Abstraction.

# Cranial Nerves

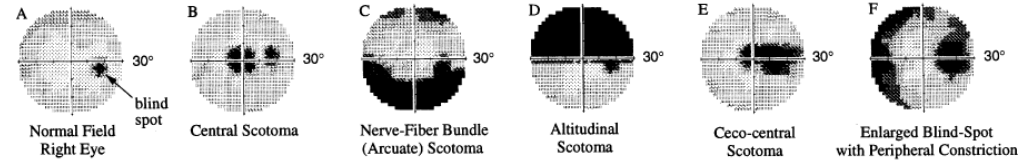
❑ **I - Olfactory**: after closed head injury and in infants with holoprosencephaly



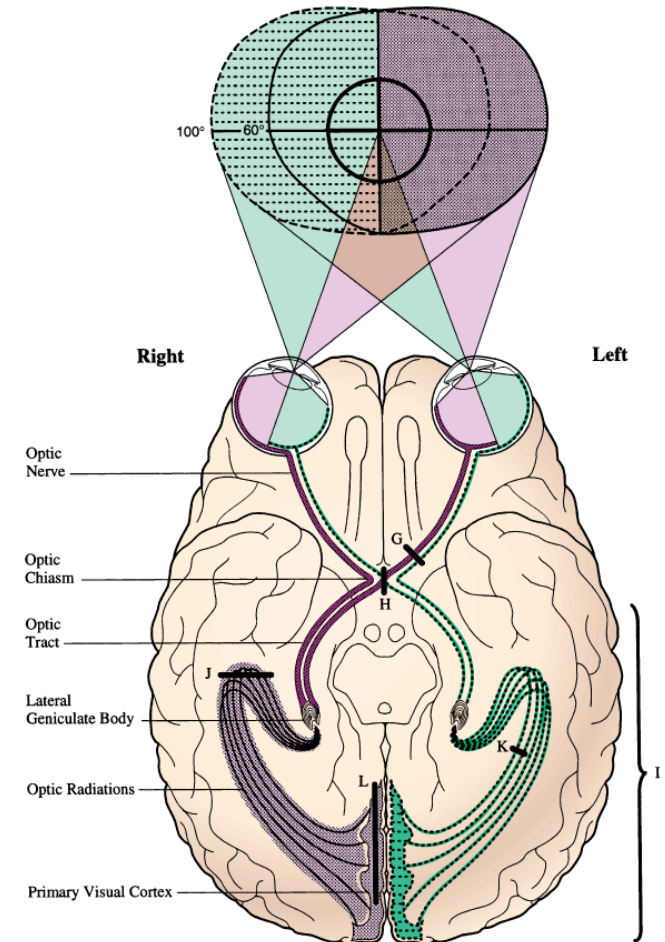
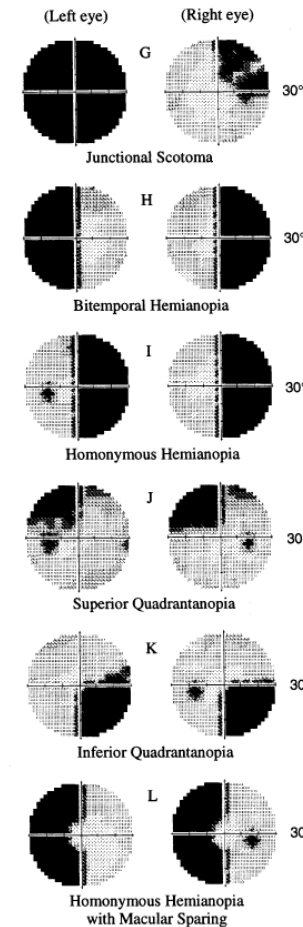
## II . Optic Nerve:

☐ Visual fields can be Tested by introducing Objects into the peripheral field of vision as the child focuses on your face.

### Monocular Prechiasmal Field Defects:



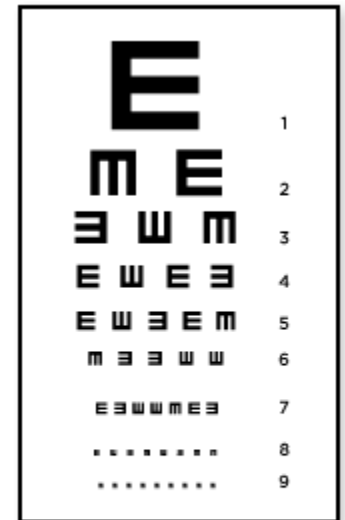
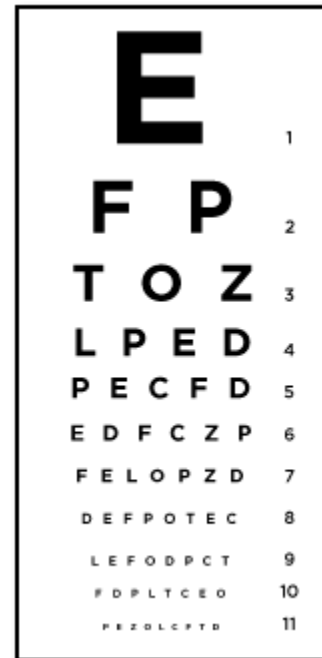
### Binocular Chiasmal or Postchiasmal Field Defects:



- Visual acuity can be tested by observing the infant reach for objects of varying size.

Standard tests can be used in older children who can recognize objects, letters, or numbers.

- Colors



- **The ophthalmoscopic** the examiner should note the sharpness and color of the **optic disc**, the pattern of blood vessels emanating from the disc, and the appearance of the retina

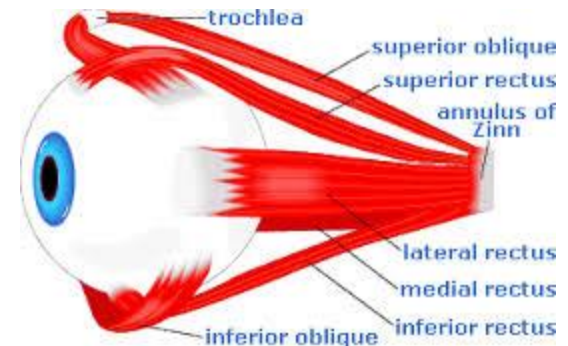
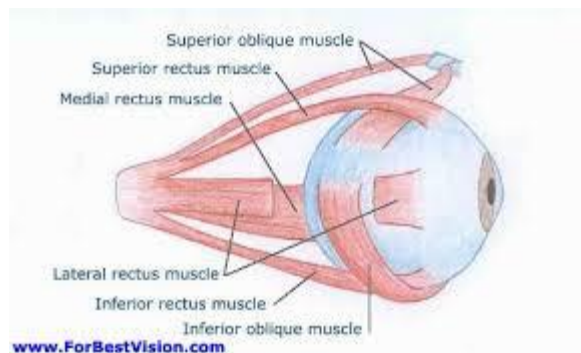


# III, IV, and VI

- **Extraocular movements:** young infants often will follow a bright colored objects such as puppets.

SO4

LR6





- The **light reflex**, **direct and indirect**, **laterally** a symmetric reflex in each pupil.

(II+III)

- **Accommodation** are also tested at this time.

# V Trigeminal Nerve

- **Facial sensation** is tested by having the child point to an area on the face that has been lightly touched with a **wisp of cotton** and report differences between right and left.
- **Corneal Reflex**
- **Motor function** is tested by having the child **open his jaw** against the resistance of the examiner's hand placed under the chin. The **masseter** can be palpated while the teeth are clenched.

## VII

- Symmetry of facial movements should be observed in the course of the examination. The **nasolabial folds** and cheeks should be symmetrical as the **teeth** are displayed. The patient should be able to **wrinkle the forehead**, close the eyes.
- Taste sensation over the anterior two thirds of the tongue



# VIII

- **Auditory acuity** can be tested by noting the response to a tuning fork, watch tick, whispering instructions.
- Hearing should be assessed **in each ear**
- Poor head control, truncal unsteadiness, gait ataxia, nausea, vomiting and horizontal nystagmus may indicate vestibular system dysfunction



# IX, X

- The gag reflex usually is used to assess cranial nerves IX and X.

This tests both the afferent sensory and efferent motor pathways responsible for palatal movement.

- Normal phonation requires function of the tenth nerve.



# XI

- Strength of the neck and the **trapezius** and **sternocleidomastoid** muscles is tested by having the child turn his or her head against the resistance of the examiner's hand.



## XII

- As the child protrudes the tongue, its movement can be observed and **atrophy** detected.

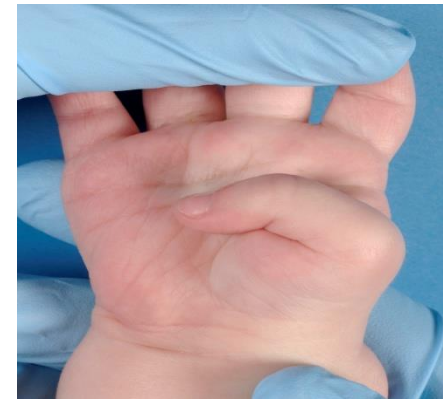


- Lateral movement of the tongue is assessed when the child **pushes against the inside of the cheek** while the examiner exerts pressure on the outside.

# Motor system

## Posture:

- Frog-leg position suggests hypotonia.
- Fisting of the hand or holding the thumb adducted across the palm during quiet wakefulness (suggests corticospinal tract involvement)
- Opisthotonus (a brainstem release phenomenon due to bilateral cerebral cortical dysfunction)





- **Tone** Tone is assessed by the resistance to **passive movement** of the limbs.
- **In infants**, tone and strength may be judged by observing the posture
- **Hypotonia and weakness** may occur separately or in combination. Hypotonia without weakness may result from dysfunction of the central nervous system. When both are present, particularly if there is hyporeflexia or areflexia, a disease of the motor unit including the anterior horn cell, root, peripheral nerve, neuromuscular junction, or muscle usually is present.

- **Increased tone** occurs with lesions of the brain or spinal cord that interfere with pathways to the motor unit.
- **Spastic**: clasp knife  
(pyramidal tract)
- **Rigidity**: lead pipe or cog-wheel  
(extrapyramidal lesions)



# Strength

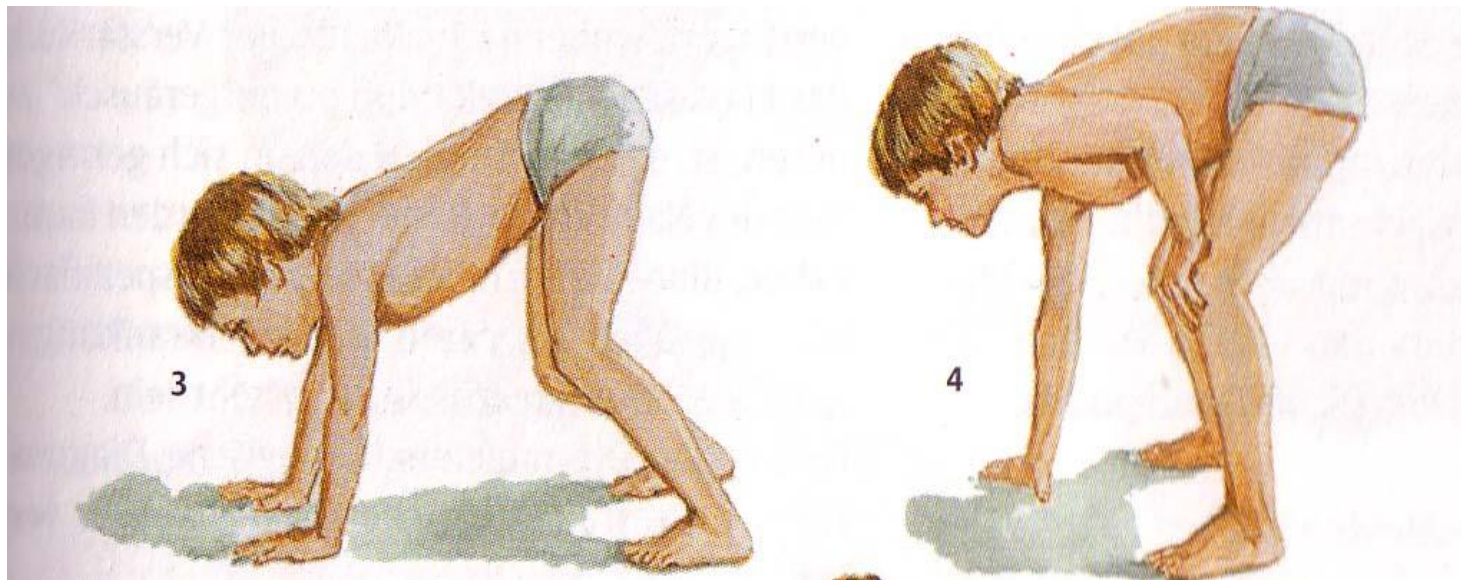
## Young Children:

- Can be evaluated by observing the child playing and walking.
- The ability to crawl, walk, and climb stairs indicates good proximal lower extremity and pelvic girdle strength.
- The ability to reach for objects above the head indicates adequate strength to oppose gravity in the upper extremities, If the child can be lifted with the examiner's hands placed in the axillae shoulder girdle strength is good
- The ability to hold the examiner's thumbs and be lifted off the floor.

This can be evaluated in children **older than four or five years** of age.

- **Grade 0/5**: No muscle movement at all
- **Grade 1/5**: Presence of a flicker of movement
- **Grade 2/5**: Movement with gravity eliminated
- **Grade 3/5**: Movement against gravity
- **Grade 4/5**: Movement against gravity and some externally applied resistance
- **Grade 5/5**: Movement against gravity and good external resistance (normal)

- **Distal weakness** (symmetric or asymmetric) generally accompanies **peripheral neuropathy**
- **Proximal muscle weakness** (generally symmetric) is seen in **myopathies**
- **Gower's sign**: when asked to come to a standing position from sitting on the floor, the patient will initially prop the hands against the floor or the lower extremities for support.



# Tendon reflexes

- It is often helpful for the examiner to cradle the joint in his own arm to support it.
- The end of the hammer should be held with the other hand and the head of the hammer allowed to drop like a pendulum so that it strikes the tendon.
- Reflexes usually tested are: Biceps, Triceps, Brachioradialis, Knee (patellar) Ankle (Achilles)

- When knee jerks are elicited, **crossed adductor responses** suggest hyperreflexia and are abnormal.
- Planter Reflex elicited by stroking the lateral aspect of the plantar surface of the foot in a posterior to anterior direction

# Developmental reflexes

## primitive reflexes



# Cerebellar Function

## Coordination

- **Observation** provides substantial information regarding cerebellar function. Sitting, balance, and walking can be observed.
- **Fine motor control** In the young infant and preschool child, fine motor control can be evaluated by watching how the upper extremities are used to play with toys and reach for objects.
- **Coordination** can be assessed also by having the child place a marble between the fingers.
- Each hand should be tested individually.



- In the preschool and older child, maneuvers such as **finger-to-nose**, **finger-to-finger**, and **heel-shin** can be performed. **Rapid alternating movements** can be assessed by asking the child to clap while alternately pronating and supinating the forearm or to tap the fingertips rapidly on an object. Impaired ability to perform this task is referred to as **dysdiadochokinesis**
- **Rebound phenomenon**



# Gait



Source: Greenberg DA, Aminoff MJ, Simon RP: *Clinical Neurology, 8th Edition*:  
[www.accessmedicine.com](http://www.accessmedicine.com)

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# Gait

- The gait, including movement of the **upper extremities**, should be observed as the child walks both away and toward the examiner.
- **A wide-based gait** is characteristic of cerebellar dysfunction.
- **Scissor Gait** often occur with spasticity.
- **A high-stepping, slapping gait** often is seen with peripheral neuromuscular disease.
- **A waddling gait** occurs with pelvic girdle weakness (eg, myopathies and muscular dystrophies).
- **Asymmetries of gait, or decreased arm swing or abnormal arm posturing** are often present in hemiparesis .

# Sensory exam

- A complete sensory examination is **difficult** to perform in **young children** because precise information cannot be obtained by observation. **Only gross deficits**, such as lack of sensation or sensitivity to temperature, which **are rare**, can be detected by formal testing. Responses to tickling, withdrawal from light prick, and apparent sensation of a wisp of cotton may provide clues about possible deficits.
- In patients **older than preschool age**, sensation of **touch and pain** can be tested with a fingertip or prick (using a sharp edge from a broken wooden tongue blade), as it is in adults.

- **Position sense** should be tested by holding the lateral aspects of a digit or extremity and moving it up or down. The pattern of movement of the digit or limb should be varied.



- **Vibration** should be tested by holding the end of a vibrating tuning fork against the bone. The tuning fork should be held intermittently to stop vibration to see if the child is responding to vibration or touch alone
- **peripheral neuropathy** or **dorsal spinal column dysfunction**



- **Cortical sensation** such as double simultaneous stimulation can be tested in the preschool child.
- **Stereognosis** (detecting the shape of an object by touch)



- **Graphesthesia** (recognizing writing on the skin) can be tested accurately **after seven to eight years of age**.  
Accurate assessment of cortical sensation requires intact primary sensation





**Superficial reflexes:** plantar, conjunctival, abdominal, and cremaster areas.

- **The plantar reflex (S1)** pointed but not sharp object, from a lateral to medial direction, posterior to anterior, stopping short at the base of the great toes. The normal response is one flexion of all toes. Patients with corticospinal tract lesions manifest an extensor plantar response (Babinski sign), which is characterized by extension of the great toe and fanning of other toes.
- **Conjunctival reflex:** cranial nerve V, facial (VII)
- The **superficial abdominal** reflexes <10>
- The **cremasteric** reflex (L1-2)

# Involuntary movements

The patient should be observed throughout the history and physical examination for involuntary movements.

- Tremor
- Myoclonus
- Chorea
- Athetosis
- Tics
- Dystonia

- **Skin examination**
- **Head**
- **Spine**
- **General physical examination**

Thank You